Hvad er økosystemtjenester – Hvorfor og hvordan anvender vi dem i praksis

Kristine Kjørup Rasmussen, biolog SLA

25.01.2021

Verden som ét stort økosystem

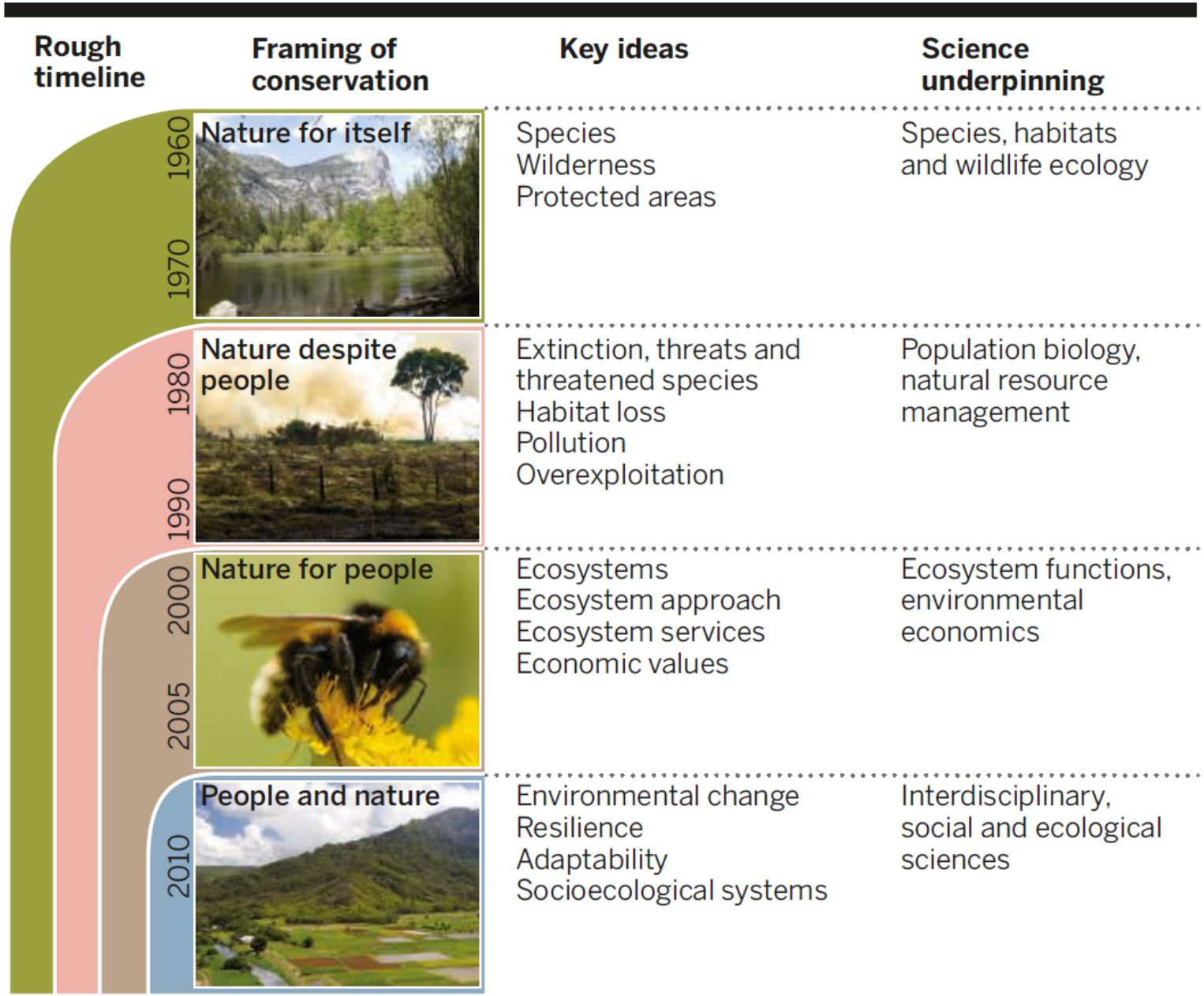
Alexander von Humboldt (1769-1859)

"Certainly, Nature in every corner of the earth is but a reflection of the whole"

Jorden er et metaøkosystem - på godt og ondt
Hvad vi gør har vidtrækkende konsekvenser.

Ved at erkende sammenhænge kan vi bedre optimere dem og vores handlinger så de gavner vores livsgrundlag i stedet for at ødelægge det.

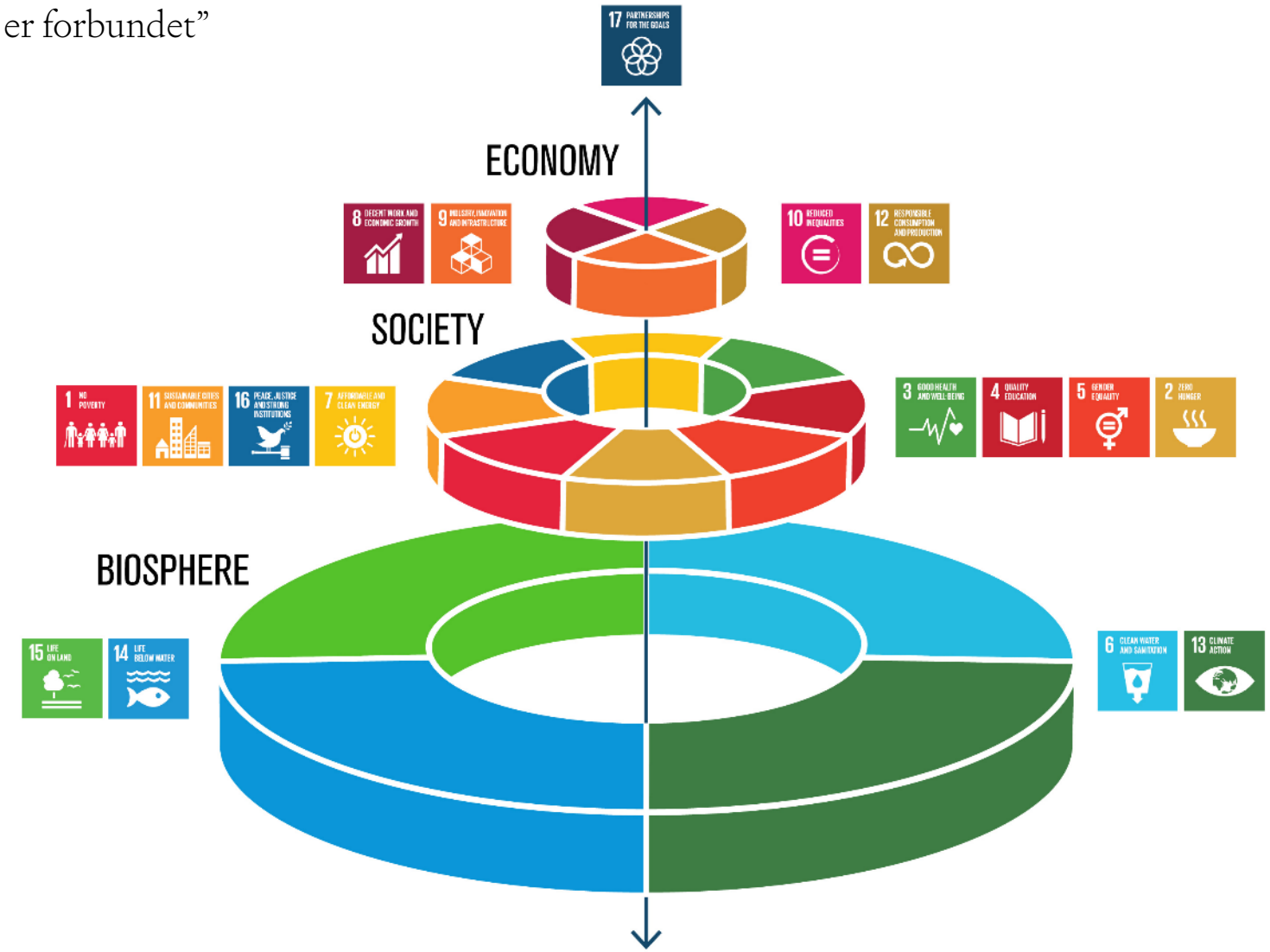
Udvikling i natursyn



Changing views of nature and conservation. Over the past 50 years, the prevailing view of conservation has changed several times, resulting, for example, in a shift in emphasis from species to ecosystems. None of the framings has been eclipsed as new ones have emerged, resulting in multiple framings in use today.

Georgina M. Mace 2014, Whose conservation? Science Vol. 345, No. 6204, pp. 1558-1560

”Økosystemtjenester er en erkendelse af at natur og mennesker er forbundet”

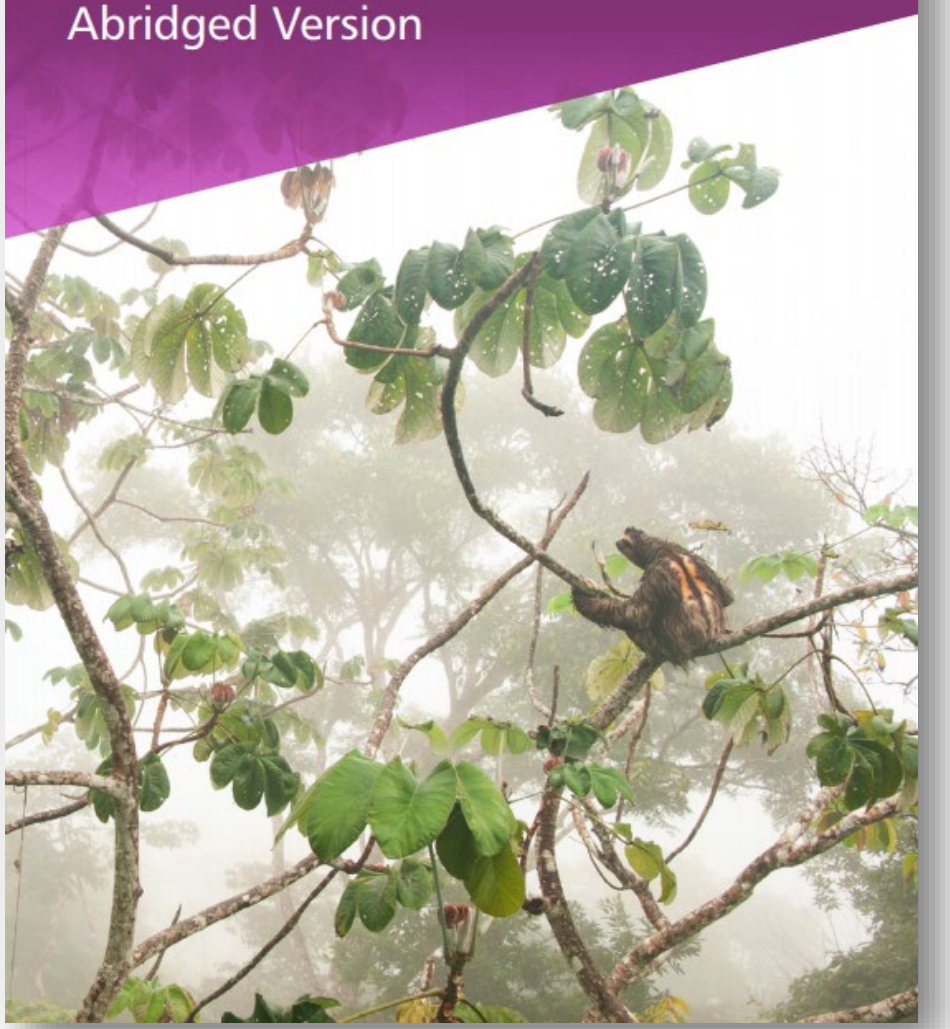


Stockholm Resilience Centre

The Economics of Biodiversity: The Dasgupta Review

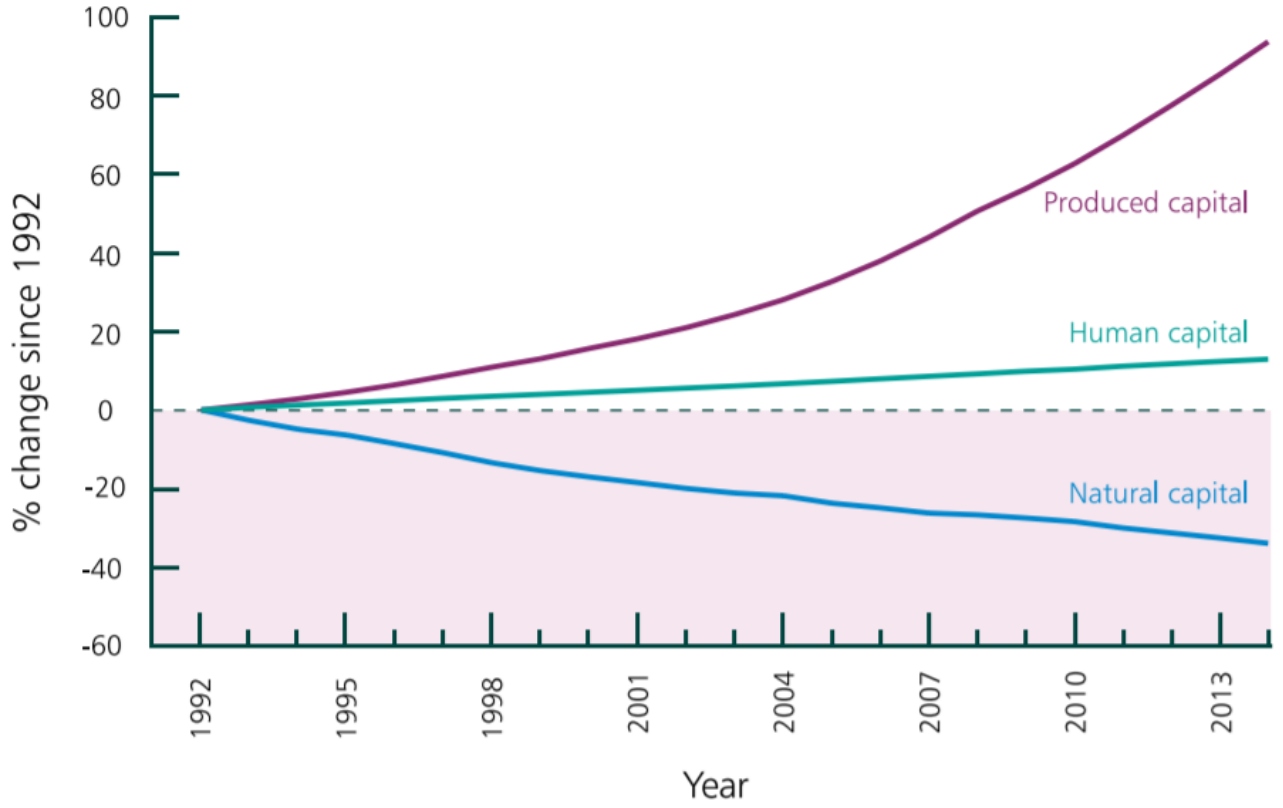
The Economics of Biodiversity: The Dasgupta Review

Abridged Version



The Dasgupta Review

Vores samfund er bygget på overforbrug af naturens ressourcer

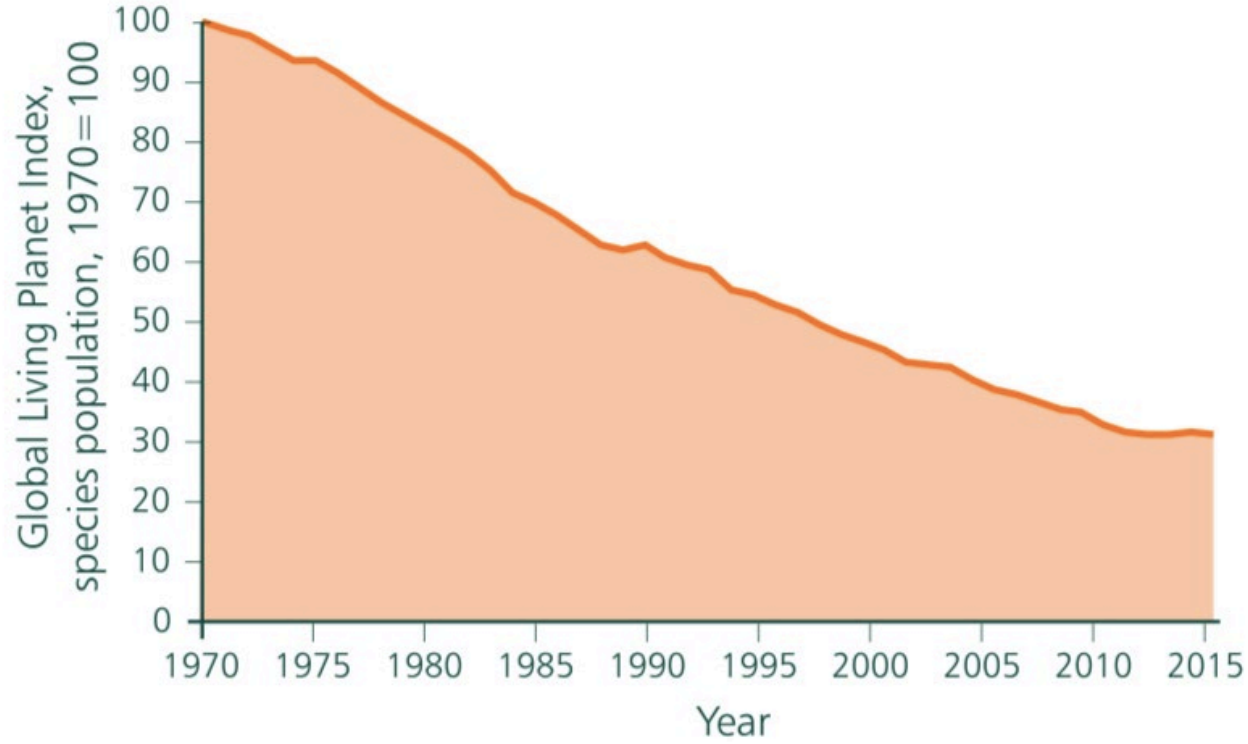


The Dasgupta Review

Arter udryddes i dag 100-1000 gange hurtigere end tidligere

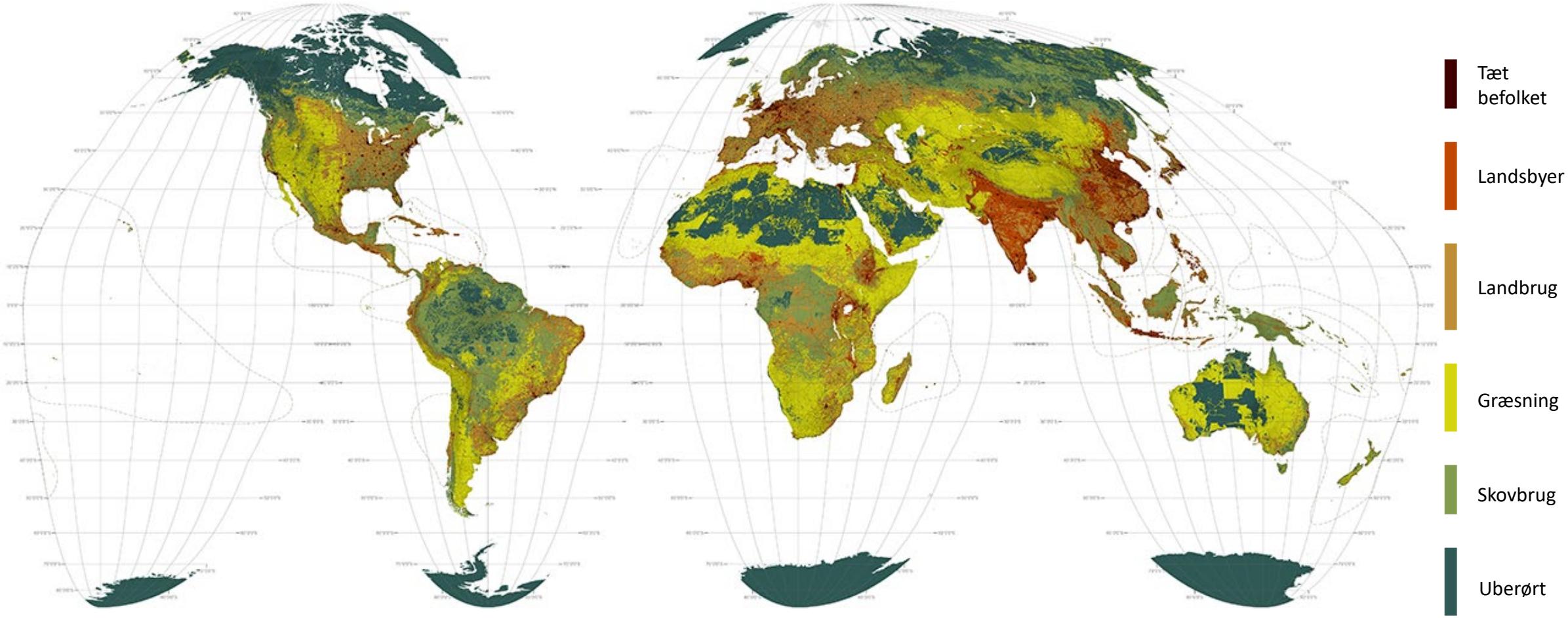
Fx er omkring 515 arter af af landlevende hvirveldyr udryddelsestruede

Figure A2.3.1 Trends in Global Vertebrate Abundance as Measured by the LPI

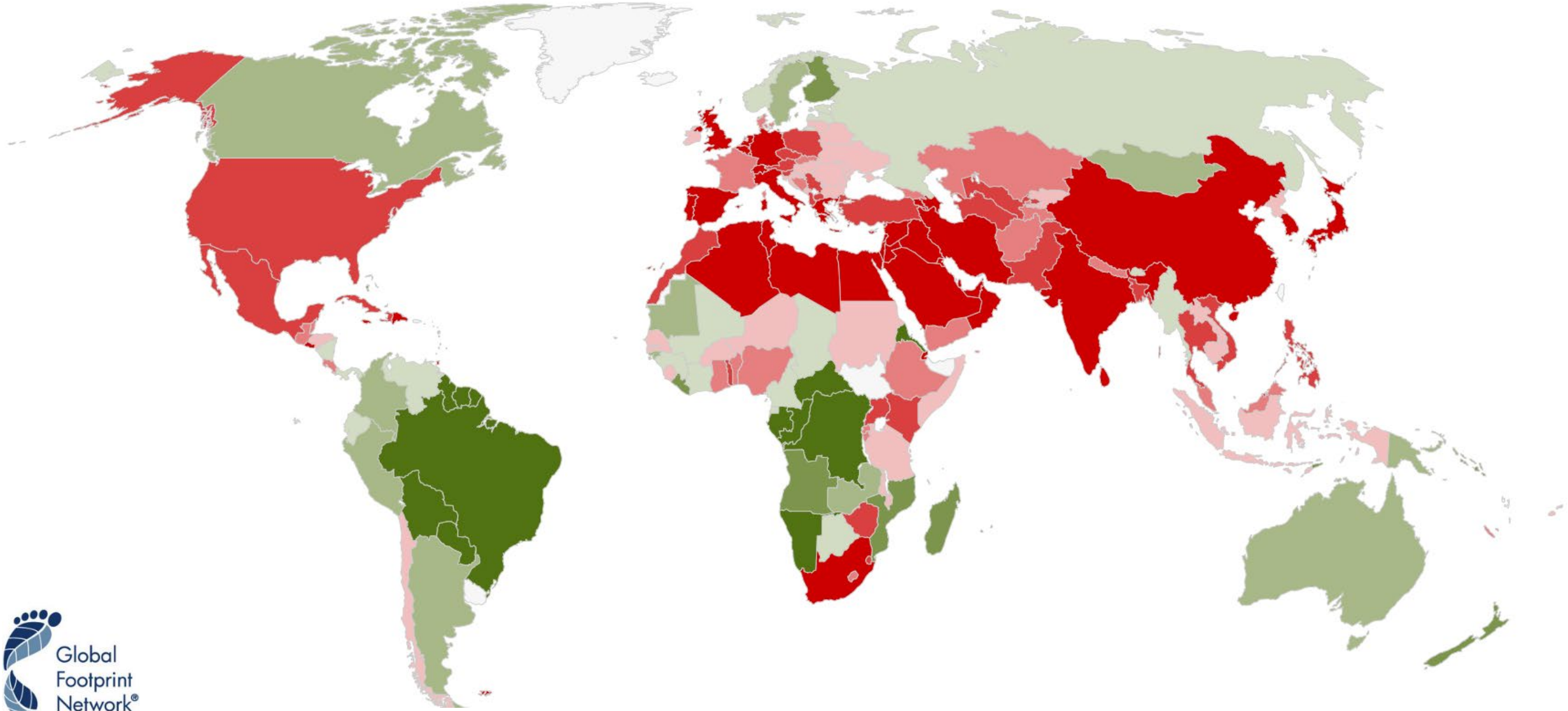


Source: WWF/ZSL (2020). Note: based on 20,811 populations of 4,392 vertebrate species.

78 % af landjorden påvirket af mennesker



Ecological footprint



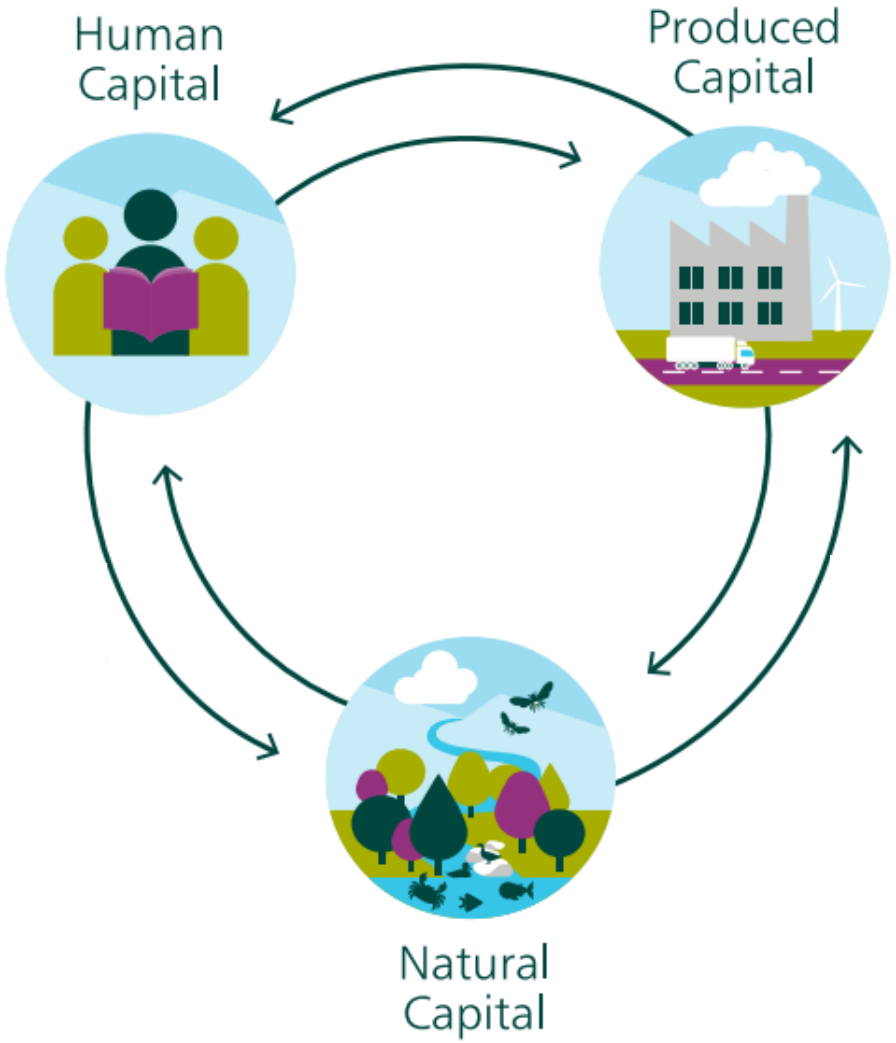
Global Footprint Network®

Globalt fodaftryk på biosfæren = 1,6

ØKO : oikos : holde hus

ØKOnomi <-> ØKOlogi

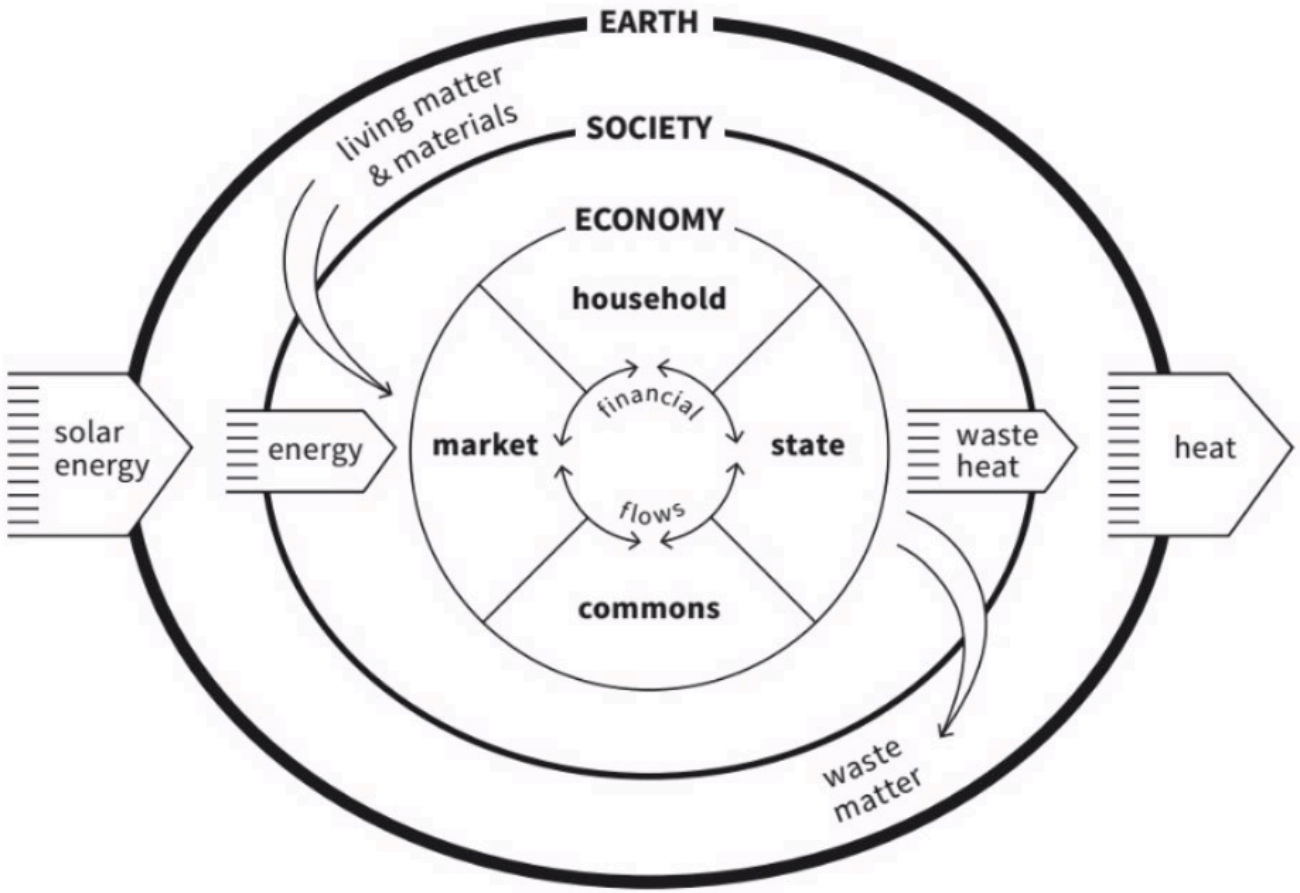
Inkluderende velstand



Man får BNP til at vokse ved at tømme sin naturkapital –
det fremgår ikke af nationalregnskabet (endnu)

(Jørgen Steen Nielsen, 2021)

Vi er indlejret i naturen

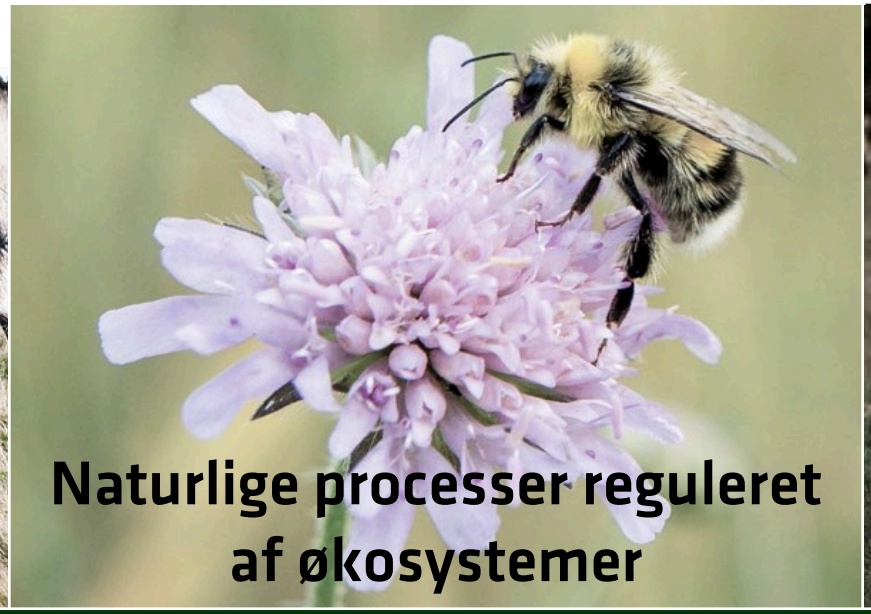


”Økosystemtjenester er goder som mennesker og samfund
får fra naturen”

FORSYNENDE

Goder og og produkter produceret af økosystemer

REGULERENDE



Naturlige processer reguleret af økosystemer

KULTURELLE

Ikke materielle goder fra økosystemer

UNDERSTØTTENDE TJENESTER

Hvad er værdi ?

Værdi er ikke en iboende egenskab ved natur eller biodiversitet

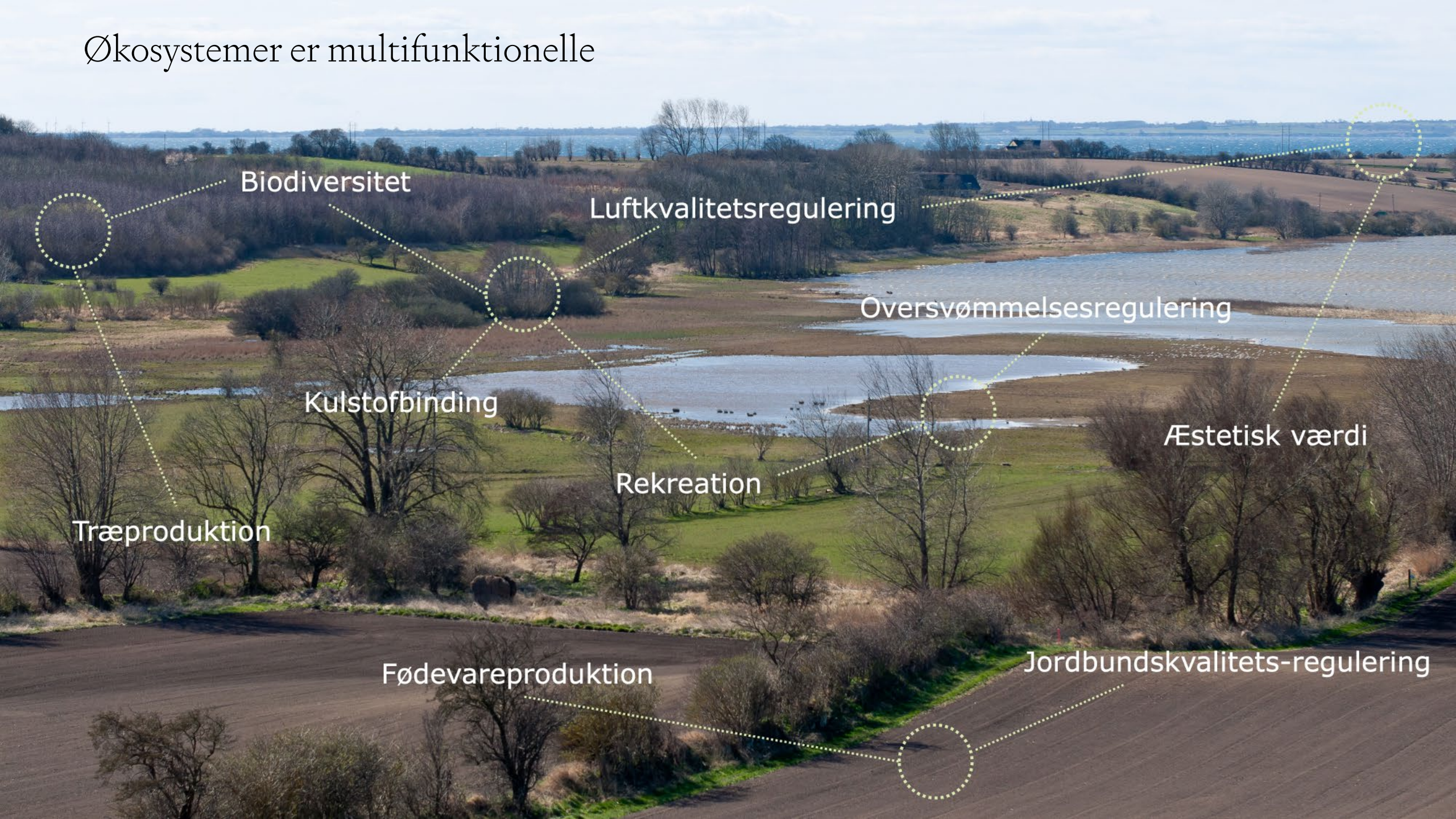
Værdi er den pris vi vil betale eller det vi vil gøre/ofre for naturen og de goder den tilbyder

Værdi afhænger af:

- Arters karakterer
- Kultur, præferencer
- Velstand
- Timing

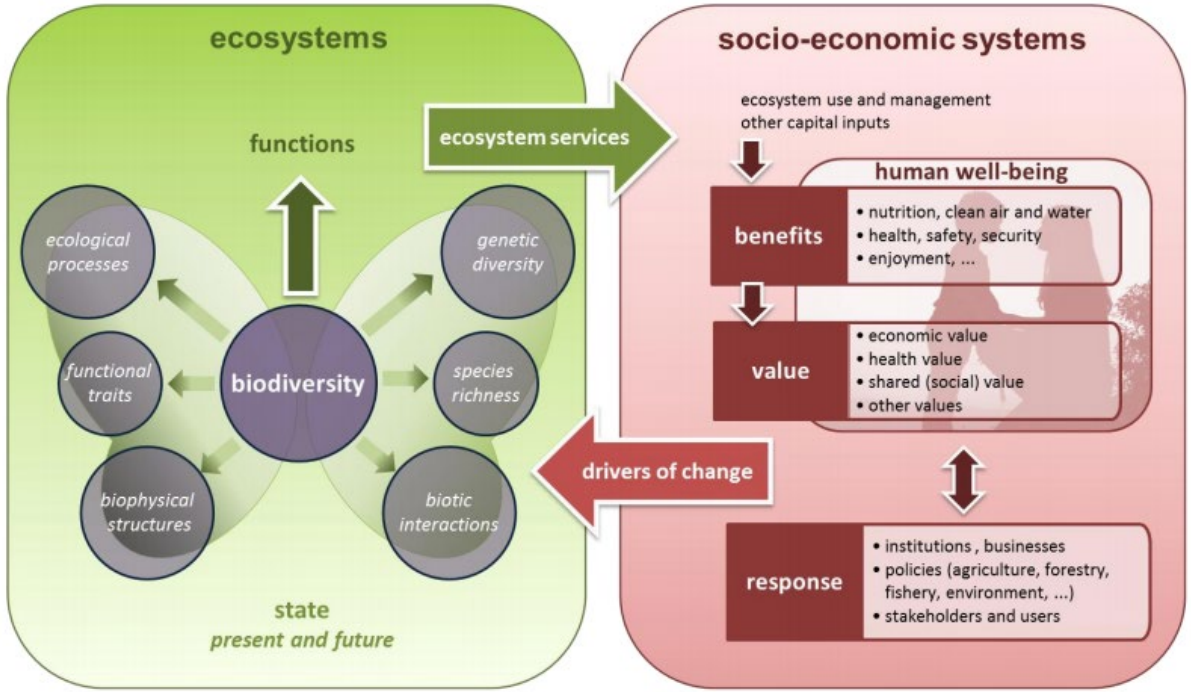
”If we do not measure what we treasure
we put our treasure at risk”

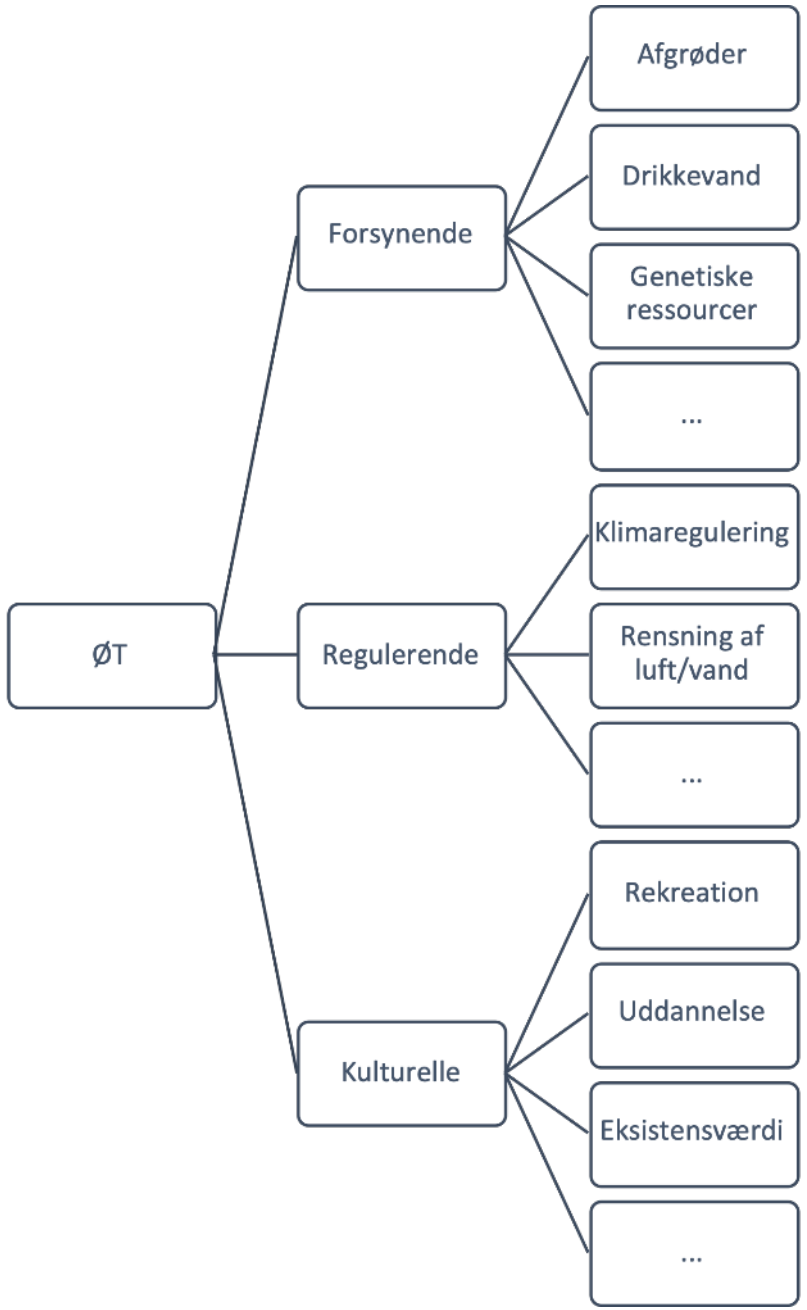
Økosystemer er multifunktionelle



EU's model for økosystemtjenester

MAES 2005: Millenium assessment of ecosystem services
TEEB: 2007: The Economics of Ecosystems and Biodiversity
CICES: Common International Classification of Ecosystem Services





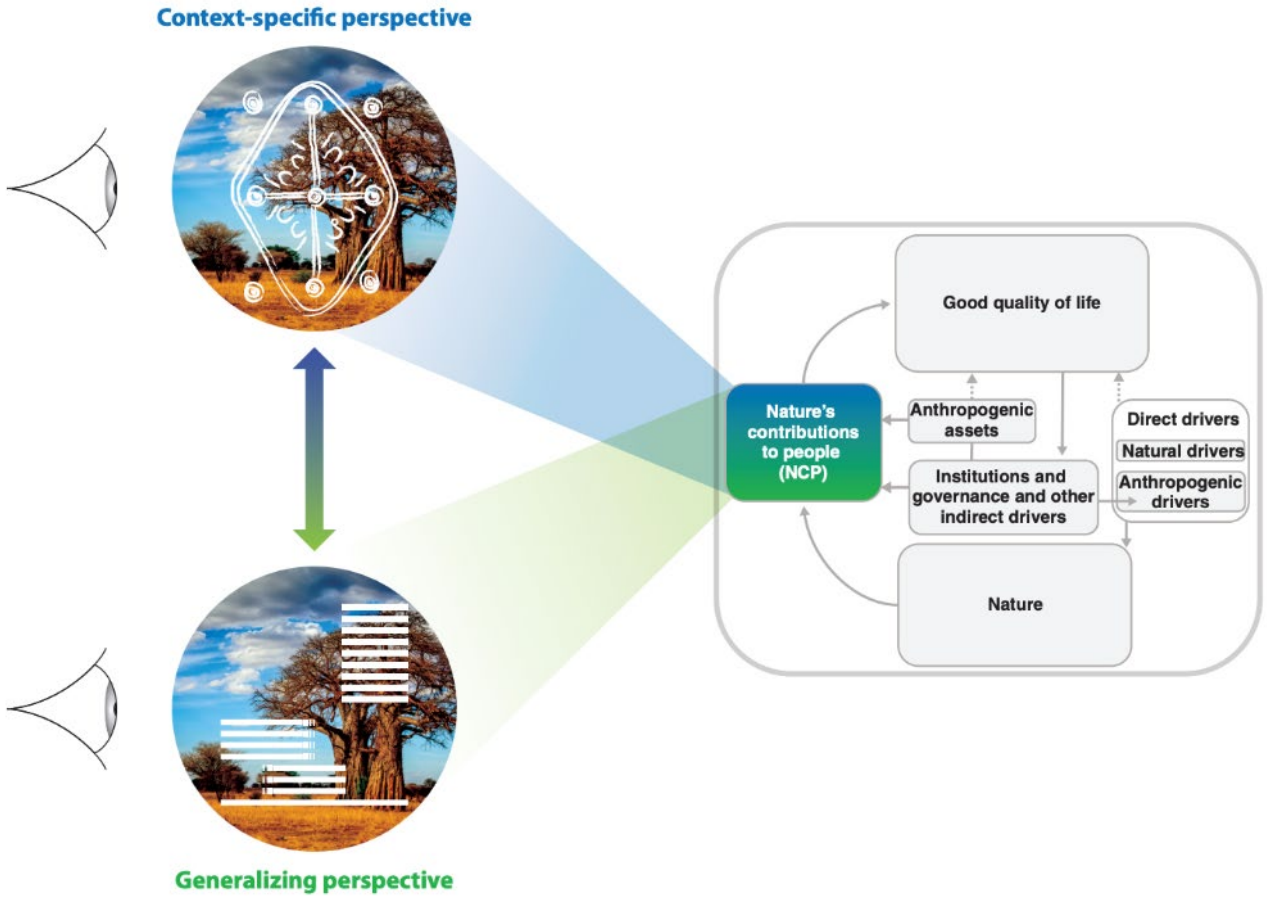
CICES 5.1

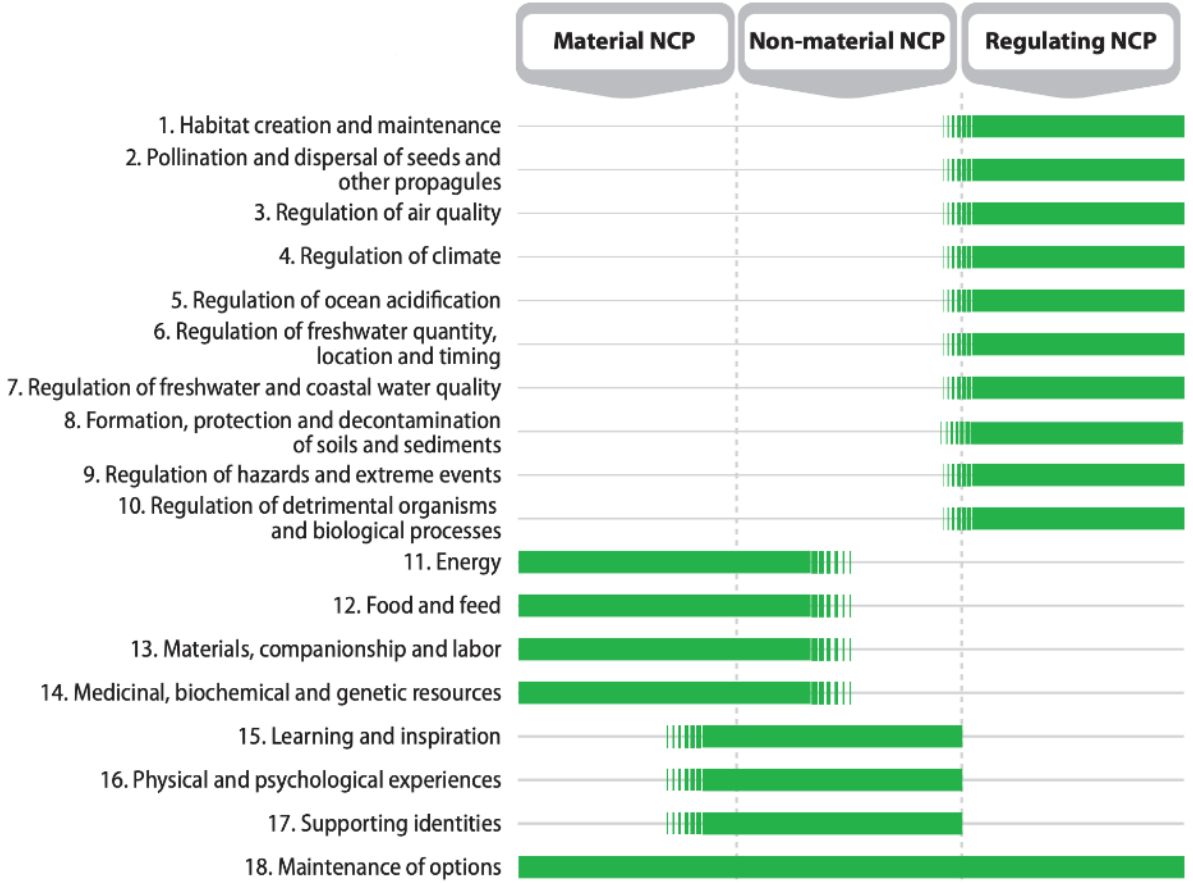
CICES V5.1 01-01-2018

Filter	Section	Division	Group	Class	Code	Class type	V4.3 Equivalent	Code(4.3)	Simple descriptor	Ecological clause	Use clause	Example Service	Example Goods and Benefits	Literature examples for individual services	Literature examples for multiple ecosystem services	Marine CICES (Relevance)	IPBES Code	IPBES Name	MA	TEEB
CICES	**Provisioning (Biotic)**	Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	1.1.1.1	*Crops by amount, type (e.g. cereals, root crops, soft fruit, etc..)*	*Cultivated crops*	*1.1.1.1*	*Any crops and fruits grown by humans for food; food crops*	*The ecological contribution to the growth of cultivated, land-based crops.....*	*...that can be harvested and used as raw material for the production of food*	*Standing wheat crop before harvest (Proxy for: ecosystem contribution to growth of harvestable wheat)*	*Harvested crop: Grain in farmer's store; flour, bread*		Maes et al., 2016, Mapping and Assessment of Ecosystems and their Services: This report assesses a variety of ecosystem services across the different sections, such	0	12	Food and feed	Food	Food
CICES	**Provisioning (Biotic)**	Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	1.1.1.2	*Material by amount, type, use, media (land, soil, freshwater, marine)*	*Fibres and other materials from plants, algae and animals for direct*	*1.2.1.1*	*Material from plants, fungi, algae or bacterial that we can use*	*The ecological contribution to the production of plants, fungi, algae or bacterial..*	*...that can be harvested and used as raw material for non-nutritional purposes*	*Harvestable surplus of annual tree growth*	*Processed timber (Volume of harvested wood)*		forest provisioning services: Kalaba et al., 2013, Contribution of forest provisioning ecosystem services to rural livelihoods in the Mimbo woodlands of Zambia.	0	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Cultivated plants (including fungi, algae) grown as a source of energy	1.1.1.3	*By amount, type, source*	*Plant-based resources*	*1.3.1.1*	*Plant materials used as a source of energy*	*The ecological contribution to the growth of cultivated crops:...*	*...that can be harvested and used as a source of biomass-based energy*	*Standing crop of Miscanthus at time of harvest*	*Energy production*			0	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Cultivated aquatic plants for nutrition, materials or energy	Plants cultivated by in- situ aquaculture grown for nutritional purposes	1.1.2.1	*Plants, algae by amount, type*	*Plants and algae from in-situ aquaculture*	*1.1.1.5*	*Plants that are cultivated in fresh or salt water that we eat*	*The ecological contribution to the growth of plants and algae under*	*...that can be harvested and used as raw material for the production of food*	*Harvestable surplus of seaweed biomass in situ*	*Vitamin supplement*			*1*	12	Food and feed	Food	Food
CICES	**Provisioning (Biotic)**	Biomass	Cultivated aquatic plants for nutrition, materials or energy	Fibres and other materials from in-situ aquaculture for direct use or processing (excluding genetic materials)	1.1.2.2	*Plants, algae by amount, type*	*Plants and algae from in-situ aquaculture*	*1.1.1.5*	*Plants that are cultivated in fresh or salt water that we can use as a material*	*The ecological contribution to the growth of plants and algae under*	*...that can be harvested and used as raw material for non-nutritional*	*Harvestable surplus of seaweed biomass in situ*	*Seaweed as an insulating material*			*1*	13, 14	Materials and assistance, Medicinal, biochemical and genetic	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Cultivated aquatic plants for nutrition, materials or energy	Plants cultivated by in- situ aquaculture grown as an energy source	1.1.2.3	*Plants, algae by amount, type*	*Plants and algae from in-situ aquaculture*	*1.1.1.5*	*Plants that are cultivated in fresh or salt water that we can use as an energy*	*The ecological contribution to the growth of plants and algae under*	*...that can be harvested and used as a source of energy*	*Harvestable surplus of seaweed biomass in situ*	*Seaweed as a source of energy*			*1*	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Reared animals for nutrition, materials or energy	Animals reared for nutritional purposes	1.1.3.1	*Animals, products by amount, type (e.g. beef, dairy)*	*Reared animals and their outputs*	*1.1.1.2*	*Livestock raised in housing and for grazed outdoors*	*The ecological contribution to the rearing of domesticated land-based animals and their outputs:...*	*...that can be used as raw material for the production of food*	*Increase in weight or numbers of cattle herd per year (previously the grass feeding these animals was considered the final service.)*	*Meat produced at abattoir, eggs, milk sold on farm or in shops*			0	12	Food and feed	Food	Food
CICES	**Provisioning (Biotic)**	Biomass	Reared animals for nutrition, materials or energy	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	1.1.3.2	*Material by amount, type, use, media (land, soil, freshwater, marine)*	*Materials from plants, algae and animals for agricultural use*	*1.2.1.2*	*Material from animals that we can use*	*The ecological contribution to the production of animal matter...*	*...that can be harvested and used as raw material for non-nutritional purposes*	*Harvestable number and quality of animal skins in herd*	*Hide products*			0	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Reared animals for nutrition, materials or energy	Animals reared to provide energy (including mechanical)	1.1.3.3	*By amount, type, source*	*Animal-based resources & Animal-based mechanical*	*1.3.1.2 & 1.3.2.1*	*Animal materials used as a source of energy or for traction*	*The ecological contribution to domesticated or wild animal species whose*	*...that can provide a source of energy*	*Volume of dung or number of animals used for traction*	*Cooking fuel or Haulage*	Energy from manure: Yirode et al., 2009, Nonmarket co-benefits and economic feasibility of on-farm biogas energy production. Energy policy,	Energy from manure: Yirode et al., 2009, Nonmarket co-benefits and economic feasibility of on-farm biogas energy production	0	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Reared aquatic animals for nutrition, materials or energy	Animals reared by in-situ aquaculture for nutritional purposes	1.1.4.1	*Animals by amount, type*	*Animals from in-situ aquaculture*	*1.1.1.6*	*Animals that are cultivated in fresh or salt water that we eat.*	*The ecological contribution to the growth of cultivated aquatic*	*...that can be used as raw material for the production of food*	*Harvestable stock of bivalves*	*Seafood (e.g. mussels)*			*1*	12	Food and feed	Food	Food
CICES	**Provisioning (Biotic)**	Biomass	Reared aquatic animals for nutrition, materials or energy	Fibres and other materials from animals grown by in-situ aquaculture for direct use or processing (excluding genetic materials)	1.1.4.2	*Animals by amount, type*	*Animals from in-situ aquaculture*	*1.1.1.6*	*Animals that are cultivated in fresh or salt water that we can use as a material.*	*The ecological contribution to the growth of cultivated aquatic animals ...*	*...that can be harvested and used as raw material for non-nutritional purposes*	*Harvestable pearls produced by oyster beds*	*Pearls used for adornment*			*1*	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Reared aquatic animals for nutrition, materials or energy	Animals reared by in-situ aquaculture as an energy source	1.1.4.3	*Animals by amount, type*	*Animals from in-situ aquaculture*	*1.1.1.6*	*Animals that are cultivated in fresh or salt water that we can use as a source of energy.*	*The ecological contribution to the growth of cultivated aquatic animals ...*	*...that can provide a source of energy*	*Biogas from aquaculture waste*	*Energy production*			*1*	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
CICES	**Provisioning (Biotic)**	Biomass	Wild plants (terrestrial and aquatic) for nutrition, materials or energy	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	1.1.5.1	*Plants, algae by amount, type*	*Wild plants, algae and their outputs*	*1.1.1.3*	*Food from wild plants*	*Parts of the standing biomass of a non-cultivated plant species...*	*...that can be harvested and used for the production of food*	*Harvestable volume of wild berries or wild mushrooms. Or Benthic macroalgae (e.g. Dulse, Laminaria (Kelp)) and macrophytes (e.g. Salicornia and other saltmarsh plants) harvested in the shallow sublittoral and/or littoral zone*	*Berries as food or for the production of jam*	Wild food in Europe as an ecosystem survive, both food from wild plants and animals. Schulp et al., 2014, Wild food in Europe: A synthesis of knowledge and data of terrestrial wild food as an ecosystem service. http://www.sciencedirect.com/science/article/pii/S0921800914001980		*1*	12	Food and feed	Food	Food
CICES	**Provisioning (Biotic)**	Biomass	Wild plants (terrestrial and aquatic) for nutrition, materials or energy	Fibres and other materials from wild plants for direct use or processing (excluding genetic materials)	1.1.5.2	*Plants, algae by amount, type*	*Wild plants, algae and their outputs*	*1.1.1.3*	*Materials from wild plants*	*Parts of the standing biomass of a non-cultivated plant species...*	*...that can be harvested and used as raw material for non-nutritional purposes*	*Harvestable volume of reeds Or Macroalgae used for thickening agents, agar and superconductor electrodes*	*Roofing material*			*1*	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources

https://cices.eu/resources/

IPBES 'Natures cnstribution to people'





STATUS FOR KORTLÆGNING AF ØKOSYSTEMER, ØKOSYSTEMTJENESTER OG DERES VÆRDIER I DANMARK

Videnskabelig rapport fra DCE – Nationalt Center for Miljø og Energi nr. 147 2016

AARHUS UNIVERSITET
DCE – NATIONALT CENTER FOR MILJØ OG ENERGI

UDVIKLING OG AFPRØVNING AF METODE TIL MODELLERING AF ØKOSYSTEMTJENESTER OG BIODIVERSITETSINDIKATORER

– med henblik på kortlægning af synergier og konflikter ved arealtiltag

Videnskabelig rapport fra DCE – Nationalt Center for Miljø og Energi nr. 226 2017

AARHUS UNIVERSITET
DCE – NATIONALT CENTER FOR MILJØ OG ENERGI

Assessing ecosystems and their services in LIFE projects

A guide for beneficiaries

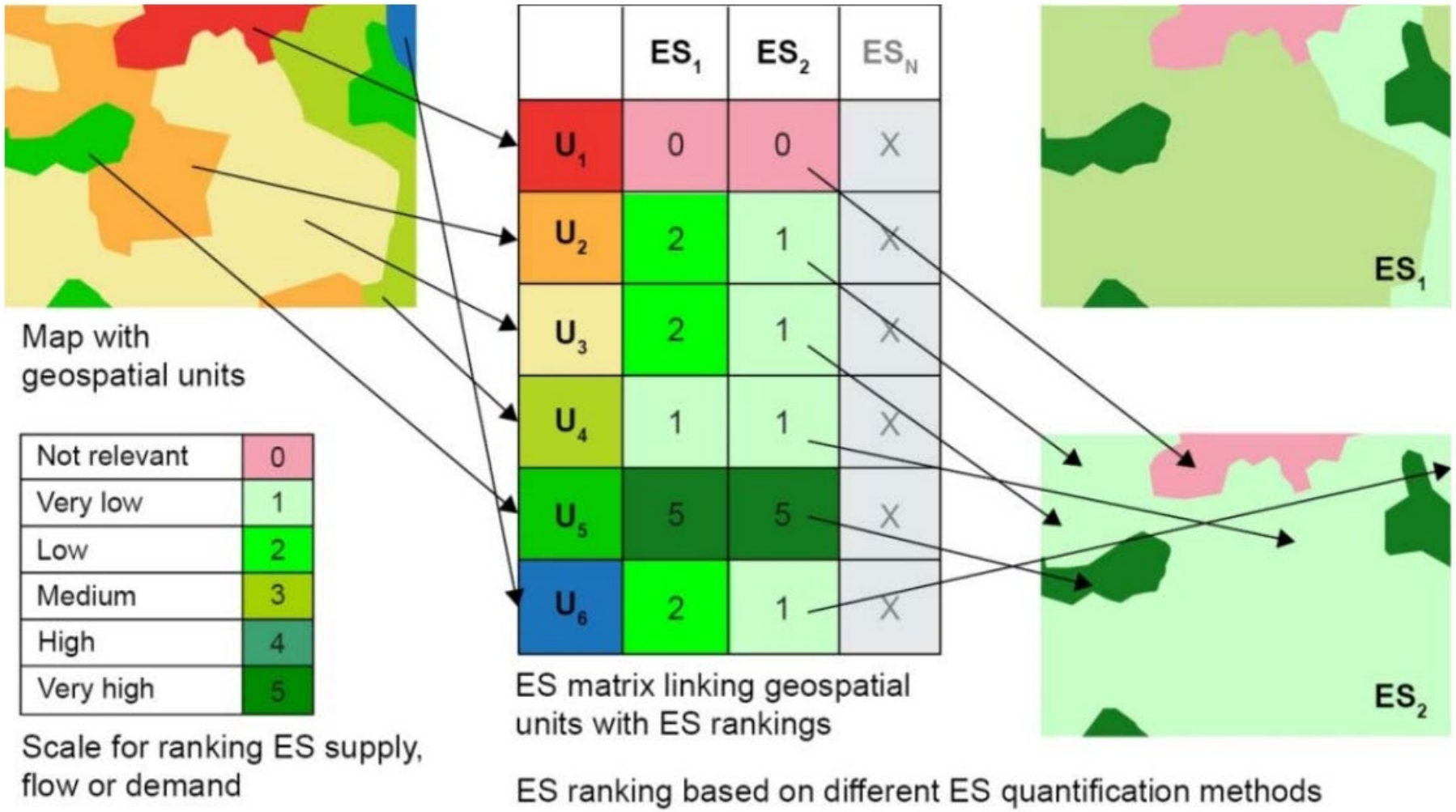
Eksempler på økosystemtjenester i N2000-områder

ECOSYSTEM TYPE	DIVISION	GROUP	CLASS	INDICATORS
Forest	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, Habitat and gene pool protection	Maintaining nursery populations and habitats	Forest area designated for habitat-landscape protection: Natura 2000
Cropland and grassland	Spiritual, symbolic and other interactions with biota, ecosystems, and land/seascapes	Other cultural outputs	Existence	Cropland or grassland in protected agricultural areas (e.g. Natura 2000, Biosphere reserve, World Heritage sites)
Freshwater	Physical and intellectual interactions with biota, ecosystems, and land/seascapes	Physical and experiential interactions	Experiential use of plants, animals and land/seascapes in different environmental settings	*For lakes and rivers*: National Parks and Natura 2000 sites *For wetlands*: Visitors to National Parks or protected areas including wetlands and/or Known bird watching sites
	Spiritual, symbolic and other interactions with biota, ecosystems, and land/seascapes	Other cultural outputs	Existence	Number of visitors (to national parks including lakes, rivers, wetlands or hot mineral spring water)
Marine	Physical and intellectual interactions with biota, ecosystems, and land/seascapes	Physical and experiential interactions	Experiential use of plants, animals and land/seascapes in different environmental settings	Extent of marine protected areas (km^2/ha)
	Spiritual, symbolic and other interactions with biota, ecosystems, and land/seascapes	Other cultural outputs	Existence	

3 niveauer af analyse

	1	2	3
Purpose	Advocacy/awareness raising and communication	Assessment not implying any decision	Assessment needed to support decision making
Data availability	Largely available (look-up tables, expert knowledge and participatory mapping	Available, also as proxy, and/or possible to get by combining existing data (for composite indicators)	Not immediately available, not harmonised at EU level, need to work on a large number of data
Measurement method	Direct measurement	Direct measurement and indirect measurement	Modelling
Resources (skills and budget)	Basic/any skills Low budget	Average/some skills (e.g. GIS) Medium budget	High skills High budget

Økosystemtjeneste matrix



Payments for ecosystem services (PES)

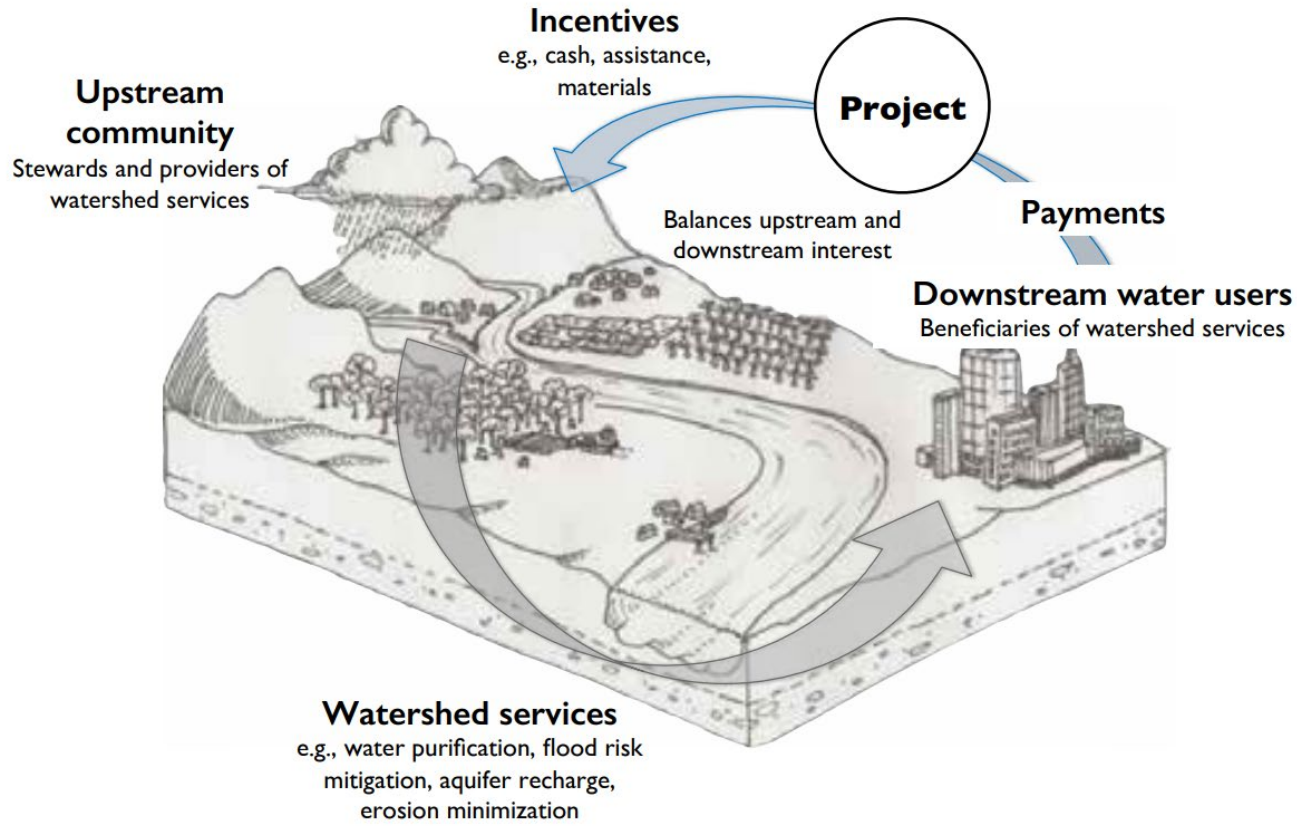
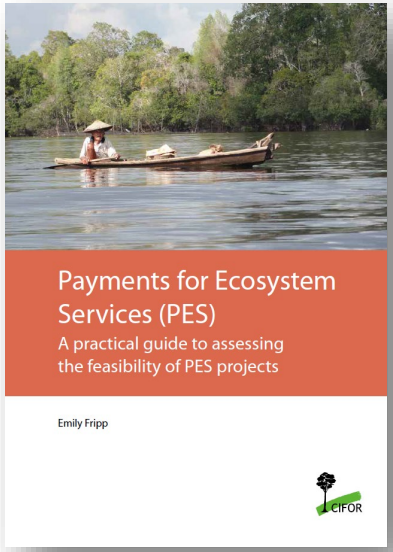
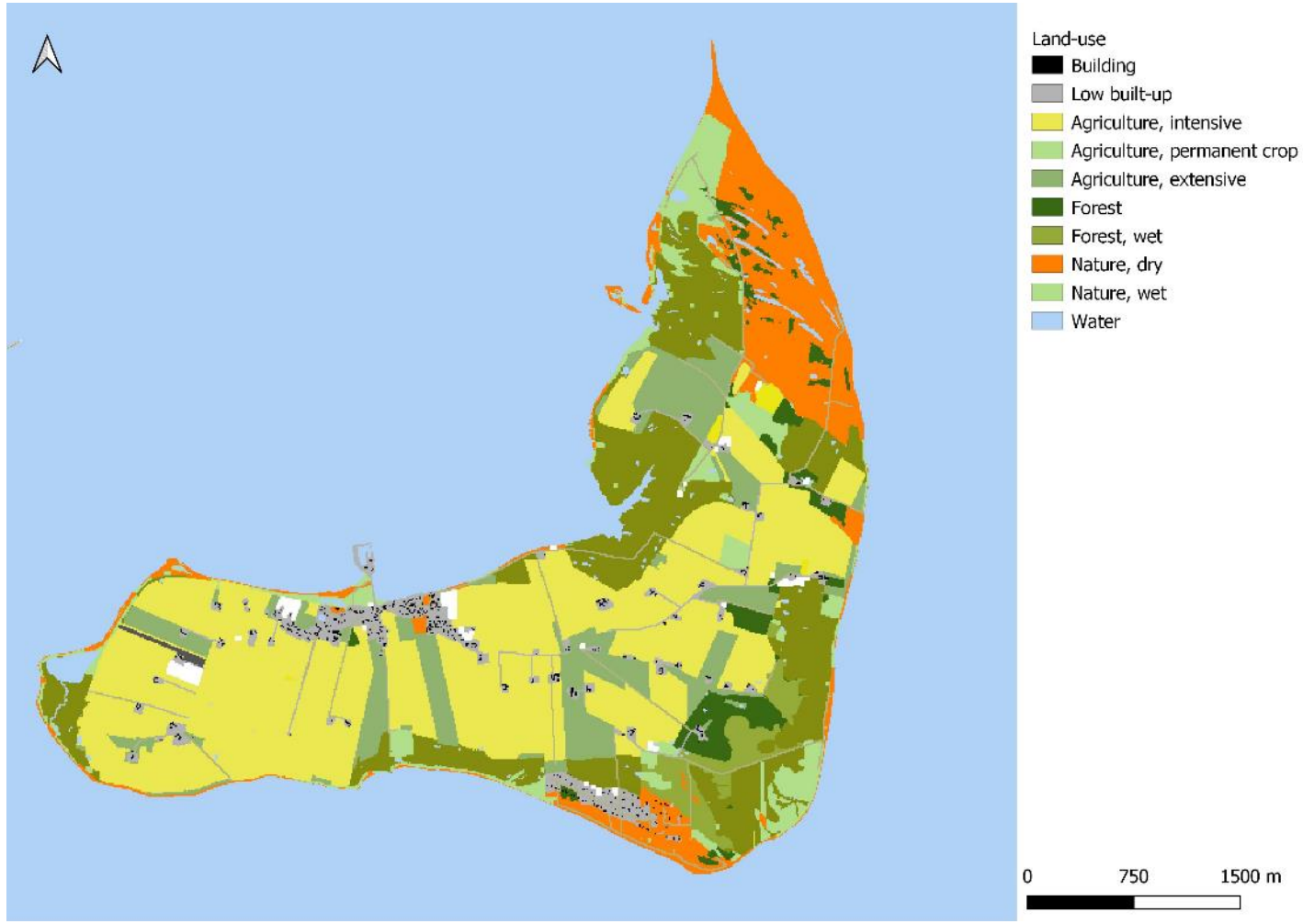


Figure 1. An example of how PES works in watersheds.

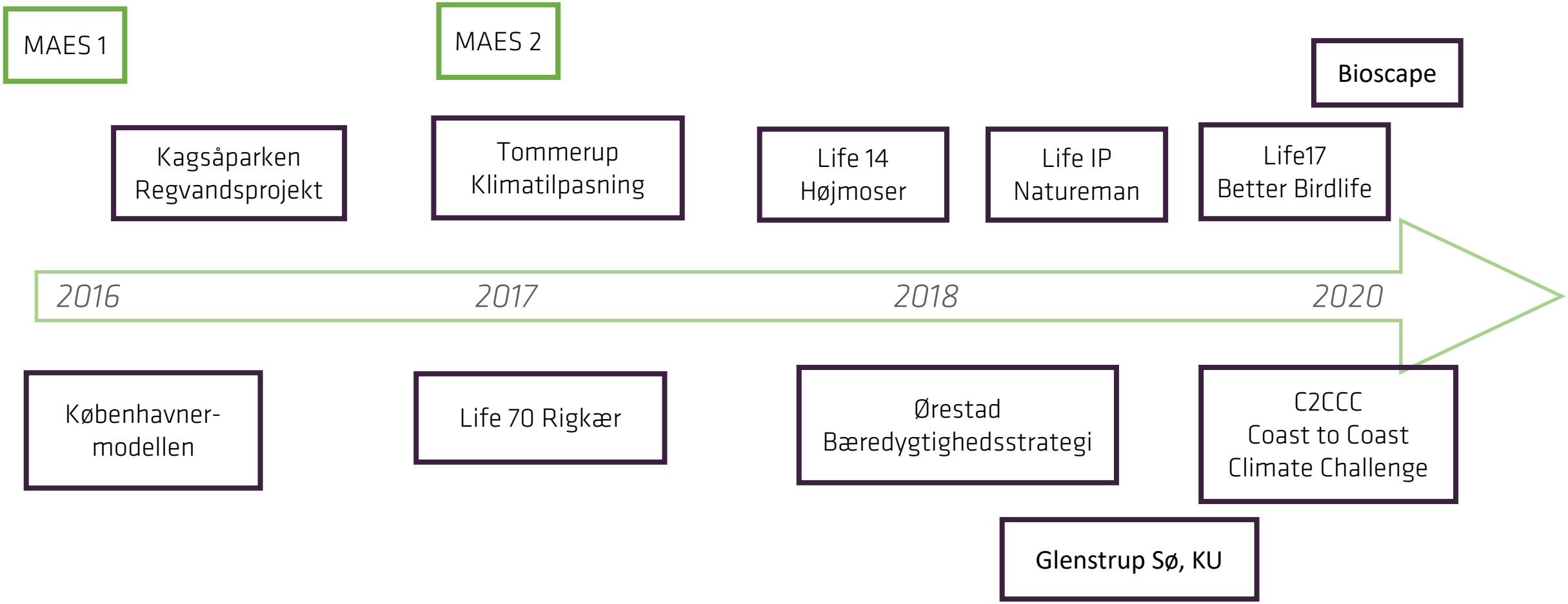


Kortlægning af økosystemtjenester

- Arealanvendelse (Basemap 2020)
- Hydrologi
- Jordbund
- Biodiversitet
- Besøgenes adfærd
- Afstand til skoler mv.
- Jagt
- …



Økosystemtjeneste projekter fra DK



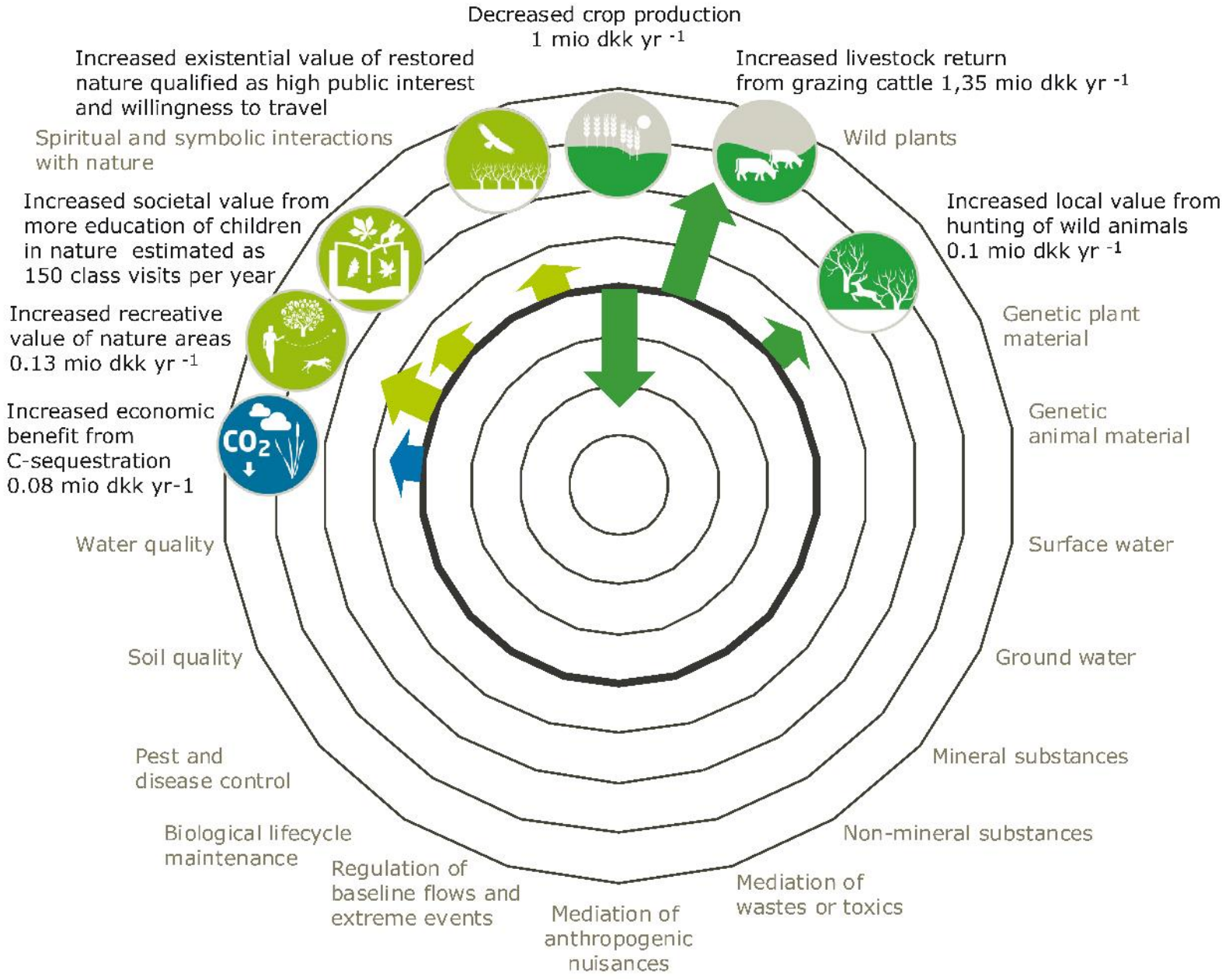
LIFE 70
EVALUERING MED ØKOSYSTEMTJENESTER

Rambøll 2017

SAMLEDE RESULTATER

Synergier og trade-off's

- Øget biodiversitet øger den samlede merværdi af flere økosystemtjenester
- Peger på behov for ændret driftsøkonomi og statslig planlægning



Middelfart Kommune
Kolding Kommune
Miljø- og Fødevareministeriet Naturstyrelsen
Stiftung Naturschutz Schleswig-Holstein
Fugleværnsfonden
Miljø- og Fødevareministeriet Kystdirektoratet
SDU
Sønderborg
Kerteminde Kommune
nordfyns kommune

Partnership

Better BirdLIFE is done in cooperation between 10 different partners

Contact

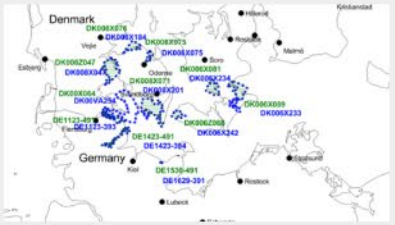
Better BirdLIFE

ABOUT BETTER BIRDLIFE PROJECT AREAS TARGET SPECIES

Better BirdLIFE

Improvement of natural habitats for coastal birds in the West Baltic Sea

Target species



Project areas

Actions

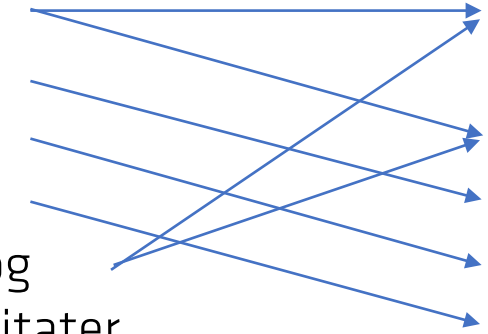
Impacts

https://betterbirdlife.middelfart.dk

Better Birdlife - Undersøgelse af økosystemstjenester

Data parametre

Variation i fuglearter
Økoturisme
Vidensopbygning
Klimaregulering
Forøget biodiversitet og biomasse i marine habitater



Økosystemtjenester

Vedligeholdelse af habitater og livscykler
Naturoplevelser
Rekreativ brug af naturområder
Intellektuel interaktion med natur
Kulstof-binding

Økosystemtjenester i urbane områder

Potentielt øgede ejendomsværdier
428 mio. kr. (4,5 %)
Årlig energibesparelser 51 %
Årligt CO2 regnskab -472 %

Simon Foght-Nielsen 2020

GREEN CITIES for a sustainable EUROPE

BYNATUR BETALER SIG

12.10.2020

BYNATUR BETALER SIG

Der er både økonomi, klimaløsninger, biologisk mangfoldighed og menneskelig trivsel i bynatur. Det har vi vidst længe – og det har vi i mange år kunnet dokumentere. Men dette til trods bevæger vi os mod stadigt mere urbaniserede byer – med høje bebyggelsesprocenter og dermed øget byfortætning.
Det sætter bynaturen under massivt pres.

I København er andelen af grønne områder, ifølge Danmarks Statistik, faldet med 11 procent fra 2011 til 2018. Og et studie – målt i Aarhus, Aalborg, Odense, Herning, Svendborg og Holbæk – viser, at de grønne offentlige arealer i gennemsnit blev reduceret med 1,2 procent gennem en niårig periode.

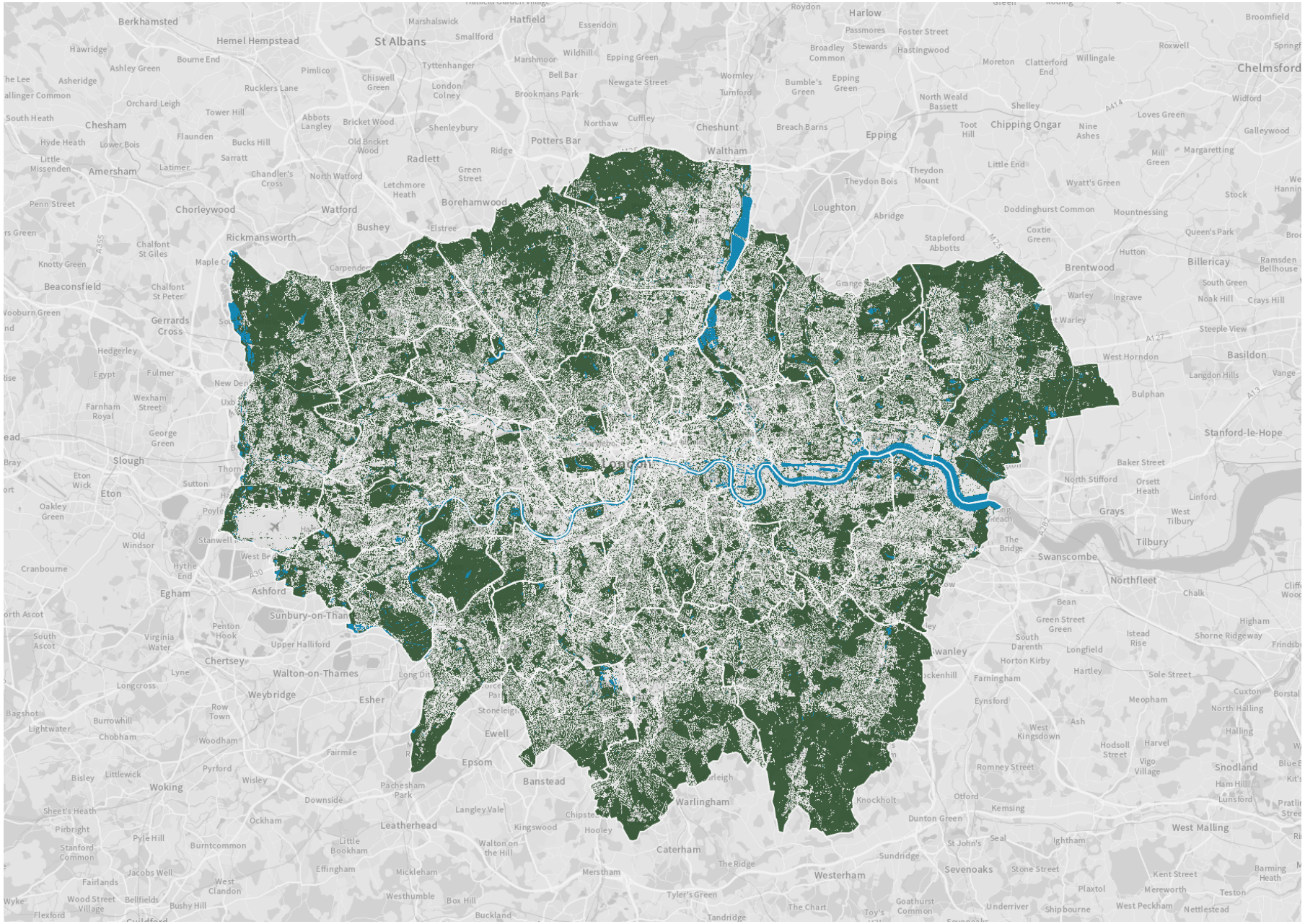
– En forklaring herpå kan være, at bynatur – på trods af de merværdier, der er forbundet hermed – står relativt svagt i dansk lovgivning om byudvikling og byplanlægning, mener Simon Foght-Nielsen, urban landskabsingeniør, der for nylig har færdiggjort et professionsbachelorprojekt med titlen: ***Grøn strukturs væsentlighed i et merværdiperspektiv.***
Heri dokumenterer han – via skybrudssikringen af området Bryggervangen og Skt. Kjelds Plads – hvordan bynatur kan gavne ud fra udvalgte merværdier i et klima-, biodiversitetsmæssigt og økonomisk perspektiv. – Det ville udgøre enorme summer, hvis vi samfundsøkonomisk beregnede alle merværdier ved bynatur, mener Simon Fogh-

Klimatilpasning Tommerup

Rambøll for Assens Kommune 2017


Kirkebjergsstenen

London
Green cover



London's trees provide at least £133m of benefits every year in terms of air pollution removal, carbon sequestion and reducing the amount of water going into drains.

2,241

tonnes of pollution removed from the air every year, worth £126M. They remove the equivalent of 13% of PM_{10} particulates and 14% of NO_2 emitted by road transport.

40%

Nearly 40% of London's surface is impermeable; 32% of ground cover is grass.

60%

Almost 60% of London's trees are in private ownership, but the trees on public land contribute 60% of the ecosystem service benefits. This is because parks and green spaces have a higher proportion of larger trees.

Trees prevent

10x

The volume of water in the Serpentine from entering London's drainage system. This helps reduce the risk of localised flooding.

Biodiversity – London's trees support and are closely associated with a wide range of priority species such as all bat species, birds like barn owl, butterflies like purple emperor, other insects like stag beetle, and fungu like oak polypore.

2,367,000

tonnes of carbon is stored in London's trees, worth £147M

Pests and diseases – If Asian Longhorn Beetles become established in London, they could damage over 3 million of London's trees leading to a reduction in ecosystem services and associated economic cost.

VALUING LONDON'S URBAN FOREST
Results of the London i-Tree Eco Project

Fig 26. Percentage of amenity value held by trees on different land use types according to CAVAT analysis. Land use types where no trees were found are omitted.